

PRO AUDIO REVIEW

EQUIPMENT REVIEW
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ETYMOTIC RESEARCH ER-4S EARPHONES

BY BRUCE BARTLETT
WITH JENNY BARTLETT

I sat alone in a hot, dark room with my ears plugged. Sounds exploded inside my head. It was just another recording job.

Actually, I was recording a band live, and I was located offstage in a large closet, monitoring the recording through Etymotic ER-4S Canal Phone™ earphones. They offer more isolation from outside sounds than any other phones that I know of. I could clearly monitor what I was recording, even though the band was just a few feet away behind a door. It was almost like working in an acoustically-isolated control room.

In addition to providing great isolation, the Etymotic ER-4S earphones are among the least colored, most detailed earphones or headphones I have heard.

Features

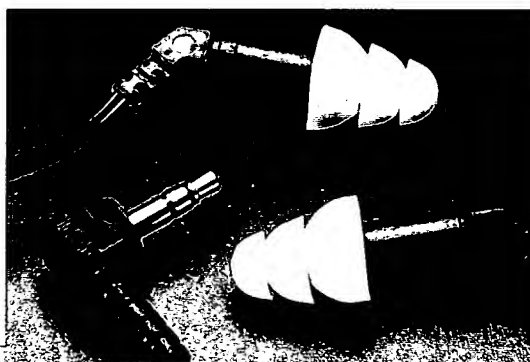
The ER-4S by Etymotic Research is a set of dynamic earphones that are inserted into the ear canals. This placement provides an air-tight seal that keeps out noise and allows deep bass.

How can these small earphones, which fit in a shirt pocket, be worth \$330? Well, just give them a listen. I would call their sound "reference quality."

One reason for this quality is that the Canal Phones' design is based on exten-

sive research into human hearing. To sound natural, earphones and headphones should not have a flat response (as measured at the eardrum). Instead, they need a big emphasis in the upper midrange — a broad 15 dB peak at 2.8 kHz. Why is this?

When listening to sound in a reverberant room, sound approaches randomly from all directions. That is, we hear a



AT-A-GLANCE

Applications: Live sound recording.

Key Features: Inserts into ear canals; compressible foam ear seal or triple flanges made of soft silicone rubber; four-foot cable, gold-plated mini phone plug and 1/4" phone plug adapter.

Price: \$330

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AT 847-228-0006.

diffuse sound field. The head, outer ears, and ear canals affect the incoming sound by adding a big peak around 3 kHz. Since earphones bypass the head and outer ears, the

3 kHz peak is missing. It needs to be restored by tailoring the response of the earphones.

Etymotic claims that its earphones have the most accurate match to the ear's diffuse-field response. The model ER-4B closely matches the diffuse curve. It is meant for listening to binaural recordings made with a dummy head placed in the

audience area. The model ER-4S has slightly reduced highs, and sounds more natural when used to listen to the usual closed-mike recordings of classical and popular music. The ER-4S

sounds best with most recordings.

Each black plastic earphone resembles an earplug. A red flex relief denotes the right channel; blue denotes left. The phones have a thin four-foot cable, gold-plated mini phone plug, and gold-plated 1/4" phone plug adapter. Two types of ear seals are provided: compressible foam, or triple flanged made of soft white silicone rubber. Extra ear seals are included. If your ear canals are unusual in size or shape, the tips might be uncomfortable or have a poor seal. For best fit, order custom-fitted earmolds. A shirt clip and a foam-lined case complete the package.

Since earwax can clog the filters built into the earphone tips, Etymotic suggests that you clean your ears before use. (I put some cotton swabs in the carrying case

for this purpose.) If the filters get clogged, they can be replaced with the spare filters provided. The inner end of each ear seal is about 1/4" from your eardrum when fully inserted. Some users might not like the sealed-off effect. It is like wearing earplugs. In fact, the isolation from outside sounds is excellent (24 dB or more). When wearing the Canal Phones, you are in a musical world of your own. They are great for listening in noisy environments (e.g., airplanes), or for monitoring a recording in the same room as the band.

According to Etymotic Research, quiet musical sounds on recordings are masked by the ambient noise level in homes (typically 43 dBA). This noise prevents the softest sounds from being heard unless you turn up the volume to unnatural levels. But when wearing the Canal Phones, the full dynamic range can be heard without excessive volume.

Specifications provided by Etymotic Research include a frequency response of 50 Hz–10 kHz ± 2 dB; 20 Hz–16 kHz ± 1 dB ref. nominal response, which mimics the diffuse-field response of the ear. 1 kHz sensitivity is said to be 108 dB SPL for 1.0 V input. Impedance is 100 ohms nominal, and maximum output is 115 dB SPL.

In use

After some time, the earphones may become uncomfortable — more so than around-the-ear headphones. (Etymotic reports that some users have no discomfort, or they get used to the earphones over time). Another drawback is that they cannot be put on quickly. During a sound check, the engineer runs around fixing buzzes, talking with people, and throwing on some headphones for a cue check. This cannot be done with the ER-4S earphones. I recommend using standard headphones during the sound check, then switching to the ER-4S earphones for the mix.

When I first listened to the ER-4S with the soft flanged ear seal, I was disappoint-

ed by the weak bass and sizzly highs. The company cautions that if the earphone is not tightly sealed to the ear canal, the bass response will be reduced. I switched to the ear seals made of foam, which accommodate larger ear canals and conform better to their shape. I rolled them tightly between my fingers, put them in my ears, and let the foam expand to form a perfect seal. Then I heard plenty of deep bass.

I auditioned the ER-4S earphones playing a variety of CDs. Here are my impressions of how they reproduce musical instruments:

- Cymbals and percussion: Smooth and sweet. Naturally bright, but not sizzly.
- Drums: Naturally crisp. Good impact.
- Kick drum: Deep, clean.
- Deep bass-drum roll: Weighty.
- Piano: Clear, natural, no tubby colorations.
- Acoustic guitar: Delicate. Clear but not edgy.
- Electric guitar: Not puffy. Good bite or edge.
- Voice: Natural. Not excessively sibilant.
- Sax: Natural. Just enough edge or breathiness.
- Electric bass: Deep and articulate.
- Acoustic bass: Not tubby. Notes are even volume. Full but clean.
- Orchestra: Natural.

The overall bass seems just a bit leaner than with most other headphones, as if the low-frequency response were down in level. Maybe other headphones just exaggerate the bass. The "lean bass" effect is subtle, and may be due just to the lack of feeling the bass in the body. I compared the current version of the ER-4S with a unit I had tested several years ago. The latest unit has more bass than the earlier one — a step in the right direction.

To hear the bass with no standing waves and no resonances is a revelation! There is absolutely no boominess or bumped-up bass often heard with other headphones or speakers. The rest of the audio range

sounds accurate and neutral as well. Cymbals are every bit as crisp and airy as the real thing.


Summary

The ER-4S earphones also offer excellent detail and low distortion. Transient response and clarity are phenomenal. Due to the low-moving mass of the earphones' diaphragm, it tracks the incoming signal accurately. These are the most transparent phones I have had the pleasure to audition. They reveal sonic differences in connector materials. I say that the ER-4S earphones compete with electrostatic headphones selling for \$1,000 or more.

If you need reference-quality sound with noise exclusion, the ER-4S earphones will give it to you. Highly recommended.

Bruce Bartlett is a mic engineer, writer and recording engineer, author of "Practical Recording Techniques," and a contributor to Pro Audio Review. Jenny Bartlett is a technical writer. Bruce can be reached at 219-294-8388.

For more information, contact Mary Paulson at Etymotic Research at 847-228-0006.

 PRODUCT POINTS	
ETYMOTIC RESEARCH ER-4S EARPHONES	
PLUS	
+Accurate +Tight and detailed +Deep bass +Terrific isolation for live recording	
MINUS	
–May become uncomfortable –Can't be put in quickly	
THE SCORE	
The ER-4S earphones provide reference-quality sound with isolation that is ideal for live recording.	

interpreted by the Supreme Court in *Foman v. Davis*.

AFFIRMED.



**CONTINENTAL CAN COMPANY USA,
INC. and Continental Pet Technologies,
Inc., Plaintiffs-Appellants,**

v.

**MONSANTO COMPANY, Hoover Uni-
versal, Inc. and Johnson Controls,
Inc., Defendants-Appellees.**

No. 90-1328.

United States Court of Appeals,
Federal Circuit.

Nov. 13, 1991.

Rehearing Denied Dec. 26, 1991.

Holder of patent for plastic bottle with ribbed bottom structure brought infringement action against competitor. The United States District Court for the Southern District of Ohio, S. Arthur Spiegel, J., entered partial summary judgment in favor of competitor, ruling that patent was invalid, and patentee appealed. The Court of Appeals, Pauline Newman, Circuit Judge, held that: (1) fact issue as to whether patent was anticipated by another patent precluded summary judgment, and (2) fact issue as to whether patent was obvious in light of prior art references precluded summary judgment.

Reversed in part, vacated in part, and remanded.

1. Federal Civil Procedure ⇨2544

On motion for summary judgment, movant's burden is to show that no fact material to the issue is in dispute, that even if all material factual inferences are drawn in favor of nonmovant movant is entitled to judgment as matter of law. Fed.Rules Civ. Proc.Rule 56(c), 28 U.S.C.A.

2. Federal Civil Procedure ⇨2508

Summary judgment is as available in patent cases as in other areas of litigation. Fed.Rules Civ.Proc.Rule 56(c), 28 U.S.C.A.

3. Federal Civil Procedure ⇨2462

Purpose of summary judgment process is to avoid clearly unnecessary trial; it is not designed to substitute lawyers' advocacy for evidence, or affidavits for examination before fact finder, when there is genuine issue for trial. Fed.Rules Civ.Proc. Rule 56(c), 28 U.S.C.A.

4. Patents ⇨323.2(3)

Fact issue as to whether patent for plastic bottle with ribbed bottom structure was anticipated by another patent precluded summary judgment on issue of validity in infringement action. Fed.Rules Civ. Proc.Rule 56(c), 28 U.S.C.A.; 35 U.S.C.A. §§ 102, 103.

5. Patents ⇨50

Anticipation under statute requiring that patented invention be "new" requires that identical invention that is claimed was previously known to others and thus is not new. 35 U.S.C.A. § 102(a).

6. Patents ⇨65

To serve as anticipation when reference is silent about asserted inherent characteristic, such gap in reference may be filled with recourse to extrinsic evidence; such evidence must make clear that missing descriptive matter is necessarily present in thing described in reference, and that it would be so recognized by persons of ordinary skill. 35 U.S.C.A. § 102(a).

7. Patents ⇨76

Statutory "on sale" bar to patentability does not arise simply because intended customer was participating in development and testing. 35 U.S.C.A. § 102(b).

8. Patents ⇨76

Plastic bottle was not placed "on sale," so as to bar subsequent patentability, when bottle was produced for testing by potential customer, although bottle's manufacturer discussed prices and quantities with customer; development project never bore

commercial fruit and was clothed in confidentiality. 35 U.S.C.A. § 102(b).

See publication Words and Phrases for other judicial constructions and definitions.

9. Patents ⇐16(2, 3)

Obviousness in patent infringement action is reviewed as legal conclusion based upon underlying facts of four general categories, that is, scope and content of prior art, differences between prior art and claimed invention, level of ordinary skill at time invention was made, and any objective considerations that may be present. 35 U.S.C.A. § 103.

10. Patents ⇐323.2(3)

Fact issue as to whether patent for plastic bottle with ribbed bottom structure was obvious in light of prior art references precluded summary judgment on issue of validity in patent infringement action. 35 U.S.C.A. § 103.

Eugene F. Friedman, Eugene F. Friedman, Ltd., Chicago, Ill., argued for plaintiffs-appellants. With him on the brief were Edwin C. Thomas, III and David M. Novak, Bell, Boyd & Lloyd, Chicago, Ill. Also on the brief was Kurt L. Grossman, Wood, Herron & Evans, Cincinnati, Ohio.

Henry J. Renk, Fitzpatrick, Cella, Harper & Scinto, of New York City, argued for defendants-appellees. With him on the brief were Lawrence F. Scinto and Bruce C. Haas. Also on the brief were Jacob K. Stein, Deborah DeLong, Thompson, Hine & Flory, Cincinnati, Ohio, Lawrence L. Limpus, Monsanto Co., St. Louis, Mo. and Edward L. Levine, Johnson Controls, Inc., Milwaukee, Wis.

Before NEWMAN, ARCHER, and RADER, Circuit Judges.

PAULINE NEWMAN, Circuit Judge.

Continental Can Company USA and Continental PET Technologies (collectively "Continental") appeal the partial summary judgment of the United States District

Court for the Southern District of Ohio, holding that United States Patent No. 4,108,324 (the Conobase or '324 patent) is invalid.¹ Final judgment was entered on this issue, for the purpose of appeal.

Summary Judgment

[1, 2] An issue may be decided on motion for summary judgment when there is no genuine issue of material fact, and the movant is entitled to judgment as a matter of law. Fed.R.Civ.P. 56(c); *Anderson v. Liberty Lobby, Inc.*, 477 U.S. 242, 106 S.Ct. 2505, 91 L.Ed.2d 202 (1986); *Celotex Corp. v. Catrett*, 477 U.S. 317, 325-26, 106 S.Ct. 2548, 2554, 91 L.Ed.2d 265 (1986); *Scripps Clinic & Research Foundation v. Genentech, Inc.*, 927 F.2d 1565, 1571, 18 U.S.P.Q.2d 1001, 1005 (Fed.Cir.1991). The movant's burden is to show that no fact material to the issue is in dispute, that even if all material factual inferences are drawn in favor of the non-movant the movant is entitled to judgment as a matter of law. *Id.* Summary judgment is as available in patent cases as in other areas of litigation. *Chore-Time Equipment, Inc. v. Cumberland Corp.*, 713 F.2d 774, 778-79, 218 U.S.P.Q. 673, 675. (Fed.Cir.1983)

[3] The purpose of the summary process is to avoid a clearly unnecessary trial, *Matsushita Elec. Industrial Co. v. Zenith Radio Corp.*, 475 U.S. 574, 587, 106 S.Ct. 1348, 1356, 89 L.Ed.2d 538 (1986); it is not designed to substitute lawyers' advocacy for evidence, or affidavits for examination before the fact-finder, when there is a genuine issue for trial. As stated in *Adickes v. S.H. Kress & Co.*, 398 U.S. 144, 176, 90 S.Ct. 1598, 1618, 26 L.Ed.2d 142 (1970) (Black, J., concurring), "[t]he right to confront, cross-examine and impeach adverse witnesses is one of the most fundamental rights sought to be preserved by the Seventh Amendment". See also *Poller v. Columbia Broadcasting System, Inc.*, 368 U.S. 464, 473, 82 S.Ct. 486, 491, 7 L.Ed.2d 458 (1962).

While facilitating the disposition of legally meritless suits, when summary judg-

1. *Continental Can Co. USA v. Monsanto Co.*, 11 USPQ2d 1761, 1989 WL 136614 (S.D. Ohio 1989),

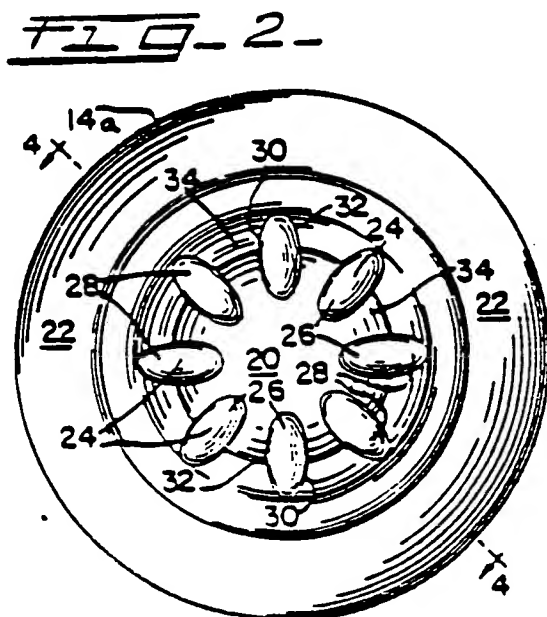
reconsid. denied, No. C-1-86-1213 (S.D. Ohio Nov. 9, 1989).

ment is improvidently granted the effect is to prolong litigation and increase its burdens. This is of particular concern in patent disputes, where the patent property is a wasting asset, and justice is ill served by delay in final resolution. In the case at bar, although some issues could be resolved on the law and undisputed facts, other issues require trial.

The Patented Invention

The '324 patent, entitled "Ribbed Bottom Structure for Plastic Container", inventors

Suppayan M. Krishnakumar, Siegfried S. Roy, John F.E. Pocock, Salil K. Das, and Gautam K. Mahajan, is directed to a plastic bottle whose bottom structure has sufficient flexibility to impart improved impact resistance, combined with sufficient rigidity to resist deformation under internal pressure. The patented bottle is said to provide a superior combination of these properties. The bottom structure is illustrated as follows:



Claim 1 is the broadest claim of the '324 patent:

1. A container having a sidewall and a bottom structure closing the container at an end portion of the sidewall,

the outer surface of the bottom structure comprising a central concavity,

a convex heel surrounding the concavity and merging therewith and with the sidewall end portion, the lowermost points of the heel lying in a common plane,

and a plurality of ribs interrupting the outer surface of the concavity and distributed in a symmetrical array,

each rib extending longitudinally in the direction of the heel and downwardly from an inner portion of the concavity, whereby the outer end portion of each

rib is lower than the inner end portion thereof,

characterized by the feature that the ribs are hollow.

Claims 2 through 5 include additional limitations, described as contributing to the structure's rigidity, flexibility, or both. Claim 2 specifies the ratios of thickness of the walls of the bottom structure to the thickness of the sidewall end portions. Claim 3 specifies that the margins of each rib merge smoothly with adjacent portions of the bottom structure. Claim 4 specifies that each rib is convex relative to the bottom structure. Claim 5 specifies that each rib is of fusiform (a gently tapered shape at the ends) configuration. Each claim carries an independent presumption of va-

lidity, 35 U.S.C. § 282, and stands or falls independent of the other claims. *Altoona Publix Theatres, Inc. v. American Tri-Ergon Corp.*, 294 U.S. 477, 487, 55 S.Ct. 455, 459, 79 L.Ed. 1005 (1935).

Continental brought suit for patent infringement against Monsanto Company and Monsanto's successor in this business, Hoover Universal, Inc. and Hoover's parent company, Johnson Controls (collectively "Monsanto"). Monsanto moved for partial summary judgment based on issues of validity under 35 U.S.C. §§ 102 and 103.

I

35 U.S.C. § 102(a)

[4] The statutory requirement that a patented invention be "new" is tested in accordance with 35 U.S.C. § 102(a), which provides that:

§ 102. A person shall be entitled to a patent unless—

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for patent....

The district court found that all the claims of the '324 patent were anticipated by U.S. Patent No. 3,468,443 (the Marcus patent). We conclude that the district court erred in claim interpretation, and also found disputed facts adversely to the nonmovant,

thus inappropriately deciding the issue summarily.

[5] Anticipation under § 102(a) requires that the identical invention that is claimed was previously known to others and thus is not new. *Scripps Clinic*, 927 F.2d at 1576, 18 U.S.P.Q.2d at 1010; *Titanium Metals Corp. of Am. v. Banner*, 778 F.2d 775, 780, 227 U.S.P.Q. 773, 777-78 (Fed.Cir.1985); *Lindemann Maschinenfabrik GmbH v. American Hoist and Derrick Co.*, 730 F.2d 1452, 1458, 221 U.S.P.Q. 481, 485 (Fed.Cir. 1984). When more than one reference is required to establish unpatentability of the claimed invention anticipation under § 102 can not be found, and validity is determined in terms of § 103.

It was Monsanto's burden to show that every element of the several claims of the '324 patent was identically described in the asserted anticipating reference, the Marcus patent. The district court focused on the term "characterized by the feature that the ribs are hollow", which limits all of the '324 patent claims. Continental argues that the district court incorrectly construed this term, as a matter of law, and that the Marcus patent shows ribs that are not hollow, as that term is used in the '324 patent. Continental also points to other differences between the '324 claims and the description in the Marcus patent.

The Marcus patent rib structure is illustrated in Figure 5 and in cross-section in Figure 6:

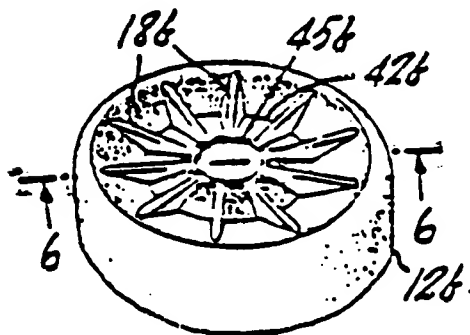


FIG. 5

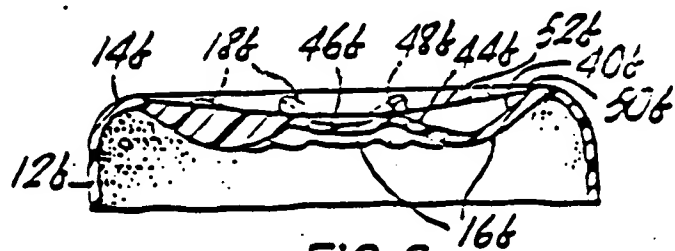


FIG. 6

The Marcus patent does not state that its ribs are "hollow", or use a similar term. Continental's witnesses testified by deposition that the Marcus patent shows solid, not hollow, ribs. A witness (Adomaitis) had stated in an internal memorandum written at Continental in 1969, well before this litigation arose, that "the ribs of their [Marcus'] web can be made of solid beams only." Another witness, '324 co-inventor Pocock, testified that:

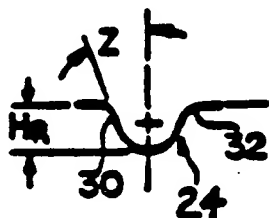
It seems evident to me that he [Marcus] was trying to produce some kind of container integrity by the production of essentially solid ribs on the bottom of the bottle. It seems to go to great length here to illustrate them as such.

Krishnakumar, another co-inventor, testified that it "is very obvious the ribs are shown solid", and that Figures 5 and 6 as well as Figures 7 through 12 of the Marcus patent all show solid ribs. However, Marcus, testifying for Monsanto, testified that his ribs were hollow, and that conventional

blow molding would inherently produce hollow ribs.

The district court defined "hollow" as meaning that "the inside contour of the ribs generally follows the outside contour thereof", a definition on which the parties agreed. *Continental*, 11 U.S.P.Q.2d at 1764. See the court's opinion, 11 U.S.P.Q.2d at 1764-68, for various sketches made by the witnesses. Continental states that the district court erred in construing "hollow", and that the phrase "characterized by the feature that the ribs are hollow" must be construed in terms of the patent in which it appears. See, e.g., *Tandon Corp. v. United States Int'l Trade Comm'n*, 831 F.2d 1017, 1021, 4 U.S.P.Q.2d 1283, 1286 (Fed.Cir.1987). The '324 patent explicitly distinguished the Marcus patent teachings, stating that the '324 ribs are, unlike Marcus, not filled with plastic. The '324 specification uses the term "hollow", as do the prosecution history and the claims, for this purpose. The '324 patent's usage of "hollow" is illustrated in the rib cross-section in Figure 5A:

FIG-5A-



The Marcus patent's rib structure thus was explicitly differentiated by the term "hollow" as used in the '324 specification, drawings, and prosecution history. Since the claim term must be construed as used by the patentee, the district court erred in its construction of the '324 claim term "hollow". On correct claim construction, the factual question of anticipation must be decided.

Monsanto's argument is that hollow ribs were inherently produced by Marcus. Monsanto thus argues that anticipation lies because the Marcus patent's ribs are "inherently" hollow, regardless of how they are shown in the Marcus patent. Monsanto argues that because the Marcus ribs are

formed by injection blow molding, which is the same process described for the Conobase '324 ribs, hollow ribs are inherently disclosed in the Marcus patent.

[6] To serve as an anticipation when the reference is silent about the asserted inherent characteristic, such gap in the reference may be filled with recourse to extrinsic evidence. Such evidence must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill. *In re Oelrich*, 666 F.2d 578, 581, 212 U.S.P.Q. 323, 326 (CCPA 1981) (quoting *Hansgirk v. Kemmer*, 102 F.2d 212, 214, 40 U.S.P.Q. 665, 667 (CCPA 1939)) provides:

Inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing *may* result from a given set of circumstances is not sufficient. [Citations omitted.] If, however, the disclosure is sufficient to show that the natural result flowing from the operation as taught would result in the performance of the questioned function, it seems to be well settled that the disclosure should be regarded as sufficient.

This modest flexibility in the rule that "anticipation" requires that every element of the claims appear in a single reference accommodates situations where the common knowledge of technologists is not recorded in the reference; that is, where technological facts are known to those in the field of the invention, albeit not known to judges. It is not, however, a substitute for determination of patentability in terms of § 103.

Continental does not dispute the applicability of the injection blow molding process. However, Continental disputes the material fact of whether this process necessarily produced "hollow" ribs in the Marcus base structure, as the term "hollow" is used in the '324 patent. Resolution of this disputed fact adversely to Continental was improper on summary judgment. The grant of summary judgment of anticipation under § 102(a) is vacated. The issue requires trial.

II

35 U.S.C. § 102(b)

The district court also held that the Marcus bottle was on sale, 35 U.S.C. § 102(b). Section 102(b) bars entitlement to a patent when:

(b) the invention was ... in public use or on sale in this country, more than one year prior to the date of the application for patent in the United States....

The Marcus bottle was developed some ten years before the filing date of the '324 patent, during a project wherein Marcus' employer, Admiral Plastics or APL Corporation, entered into agreements with the

Coca-Cola Company for the development of a suitable plastic bottle. The agreements provided that Admiral Plastics would make and Coca-Cola would test the bottles, and that if a satisfactory bottle was developed it would be manufactured by Admiral and purchased by Coca-Cola. Minimum commercial quantities and maximum commercial prices were stated in an agreement, and costs were a matter of discussion. Admiral produced a variety of bottle shapes, including the Marcus bottle. The project was terminated after about two years, because the "mechanical performance" requirements were not met, as Coca-Cola wrote at the time.

[7] The district court reasoned that this project "called for the eventual marketing of the Marcus bottles once all technical difficulties were resolved", *Continental*, 11 U.S.P.Q.2d at 1766, and on this basis held that the Marcus bottles were on sale. This holding was in error, for the "on sale" bar of § 102(b) does not arise simply because the intended customer was participating in development and testing. See *Great Northern Corp. v. Davis Core & Pad Co.*, 782 F.2d 159, 164-65, 228 U.S.P.Q. 356, 358 (Fed.Cir.1986). In *Baker Oil Tools, Inc. v. Geo Vann, Inc.*, 828 F.2d 1558, 1563-65, 4 U.S.P.Q.2d 1210, 1213-15 (Fed.Cir.1987), this court summarized various factors pertinent to the "on sale" bar when there is an issue concerning the relationship between the patentee and the customer: for example, whether there was a need for testing by other than the patentee; the amount of control exercised; the stage of development of the invention; whether payments were made and the basis thereof; whether confidentiality was required; and whether technological changes were made. All of the circumstances attending the relationship must be considered in light of the public policy underlying § 102(b). *UMC Electronics Co. v. United States*, 816 F.2d 647, 656, 2 U.S.P.Q.2d 1465, 1471-72 (Fed. Cir.1987), *cert. denied*, 484 U.S. 1025, 108 S.Ct. 748, 98 L.Ed.2d 761 (1988).

[8] The district court acknowledged that all technical difficulties were not resolved and that no sales were ever made.

Although Admiral Plastics' hope was surely commercial sales, and the record shows that prices and quantities were discussed, this does not of itself place the subject matter "on sale" in the sense of § 102(b). The Marcus bottle was part of a terminated development project that never bore commercial fruit and was cloaked in confidentiality. While the line is not always bright between development and being on sale, see generally *UMC Electronics, supra*, in this case the line was not crossed. The "on sale" bar is measured by "the time the public came into possession of the invention", *id.* at 655, 2 U.S.P.Q.2d at 1471 (quoting *In re Foster*, 343 F.2d 980, 987-88, 145 U.S.P.Q. 166, 173 (CCPA 1965), *cert. denied*, 383 U.S. 966, 86 S.Ct. 1270, 16 L.Ed.2d 307 (1966)) ("What starts the period running is clearly the availability of the invention to the public through the categories of disclosure enumerated in 102(b)...." (emphasis in original))). We conclude that the district court erred in holding that the circumstances that here existed placed the Marcus bottles "on sale" in terms of § 102(b). We therefore reverse and direct that on remand judgment on this issue shall be entered in favor of Continental, as a matter of law.

III

35 U.S.C. § 103

[9] Obviousness, 35 U.S.C. § 103, is reviewed as a legal conclusion based upon underlying facts of four general categories, *viz.* the scope and content of the prior art, the differences between the prior art and the claimed invention, the level of ordinary skill at the time the invention was made, and any objective considerations that may be present. *Graham v. John Deere Co.*, 383 U.S. 1, 17, 86 S.Ct. 684, 693-94, 15 L.Ed.2d 545 (1966); *Interconnect Planning Corp. v. Feil*, 774 F.2d 1132, 1137-38, 227 U.S.P.Q. 543, 547 (Fed.Cir.1985).

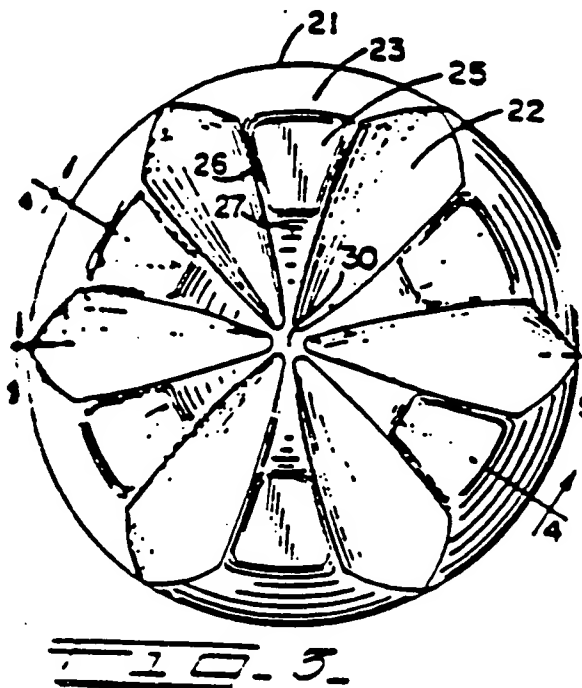
[10] The parties agreed that the scope and content of the prior art was adequately

represented by four references: the Marcus patent discussed in Part I *ante*, a patent to Colombo (U.S. Patent No. 3,403,804), and two patents owned by Continental, U.S. Patent No. 3,598,270 (the Petaloid patent), and No. 3,935,955 (the Decaloid patent). They agreed on little else. In granting summary judgment of invalidity for obviousness, the district court found certain disputed material facts and misapplied certain precepts of law. We conclude that the issue was not amenable to summary resolution. Although it is not entirely clear how the references were combined by the court, we shall review the references briefly, in order to explain our conclusion.

The Petaloid Patent

The district court referred to the deposition testimony of Siegfried Roy, one of the co-inventors of the '324 patent, that the Petaloid base, inverted, was similar to the Conobase. Continental points out that neither Roy nor any other deponent suggested that the Petaloid base could be or should be inverted, or that inversion would provide an improved base structure. In *In re Gordon*, 733 F.2d 900, 902, 221 U.S.P.Q. 1125, 1127 (Fed.Cir.1984) this court held that although a prior art device could have been turned upside down, that did not make the modification obvious unless the prior art fairly suggested the desirability of turning the device upside down.

Continental points out that the Petaloid description differs in several other ways from the '324 invention. In the '324 structure the outer end of each rib is lower than the inner end, whereas in the Petaloid structure the outer ends of the ribs are higher than the inner ends; that is, the ribs in the Petaloid base extend upward from the center to the sidewall. The Petaloid bottle is supported on feet extending between the ribs, such feet being the locations for stress concentrations. The following drawing is from the Petaloid patent:



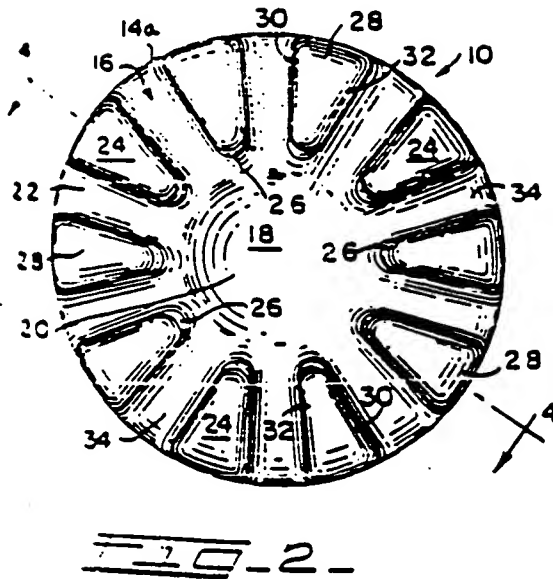
Continental states that the '324 Conobase is not only different, but avoids the stress concentrations of the Petaloid device, thus enhancing impact resistance. Monsanto argues that Continental simply used the Petaloid hollow ribs in combination with the Marcus patent. This requires determination of whether there was something in the prior art as a whole to suggest the desirability, and thus the obviousness, of making the combination, in a way that would produce the '324 structure. See, e.g., *Uniroyal, Inc. v. Rudkin-Wiley Corp.*, 837 F.2d 1044, 1051, 5 U.S.P.Q.2d 1434, 1438 (Fed. Cir.), *cert. denied*, 488 U.S. 825, 109 S.Ct. 75, 102 L.Ed.2d 51 (1988). Continental argues that it is not apparent, even with hindsight, how any combination of the Petaloid and Marcus patents or other references lead to the '324 base. The Petaloid patent shows concave ribs that extend all the way to the sidewall, while the Marcus ribs extend "from the heel" toward an annular central ring. The Petaloid base has wide, petal-like, open ribs, while Marcus

shows narrow, beam-like ribs. The deposition testimony was in conflict as to the inferences drawn from the references.

On this disputed issue, drawing reasonable inferences in favor of the non-movant, it has not been established that one skilled in the art would be motivated to select and combine features from each source in order to make the '324 base. *Interconnect Planning*, 774 F.2d at 1143, 227 U.S.P.Q. at 551 ("When prior art references require selective combination by the court to render obvious a subsequent invention, there must be some reason for the combination other than the hindsight gleaned from the invention itself").

The Decaloid Patent

The district court also referred to combination of the Decaloid base with the Marcus base. The Decaloid base has ten hollow ribs that extend to the sidewall, and ten feet between the ribs:



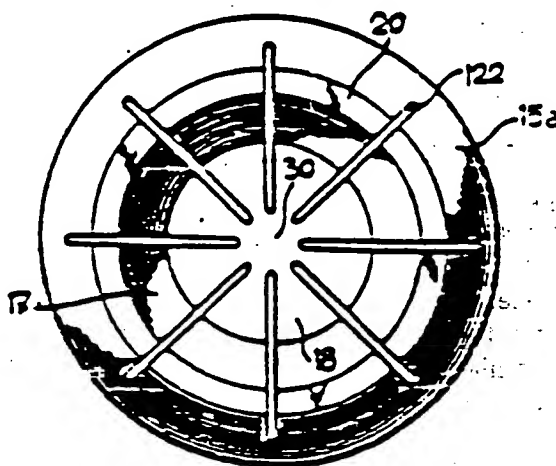
Monsanto does not explain, and we can not discern, how the combination with Marcus would have led a person of ordinary skill to the '324 base. The court's summary holding of obviousness based on these references, separately or in combination, can not be sustained.

The Colombo Patent

The Colombo base, like the Petaloid and Decaloid bases, has hollow ribs that extend

to the sidewall, in a still different structure from that of Marcus and also from that of the '324 patent. Colombo describes his ribs as inverted U-shapes, concave, located on the outer surface of the central concavity:

Fig. 4



Again, drawing reasonable factual inferences in favor of Continental, and in the absence of any suggestion or motivation in

the prior art as a whole to make a selective combination of the Colombo and Marcus

structures along with other changes needed to obtain the '324 structure, summary judgment of obviousness was inappropriate.

The district court found that there was no substantial difference between the '324 invention and the combined teachings of the prior art:

As obviousness can be established on the basis of the combined teachings of references, we think it is clear that simple enhancements of existing prior art, i.e. inverting the '270 petaloid base, do not constitute a substantial difference between the subject matter claimed in the '324 patent and that of the prior art. Thus, the facts of this case reveal no substantial difference between '324 and the prior art.

Continental, 11 U.S.P.Q.2d at 1769 (citation omitted). However, as we have discussed, the criterion of § 103 is not whether the differences from the prior art are "simple enhancements", but whether it would have been obvious to make the claimed structure.

Objective Indicia

The district court concluded that the structure in suit is simply a variation on known themes. It is in such circumstance that the objective indicia—the so-called secondary considerations—are most useful to the decision-maker. The significance of a new structure is often better measured in the marketplace than in the courtroom.

Thus when differences that may appear technologically minor nonetheless have a practical impact, particularly in a crowded field, the decision-maker must consider the obviousness of the new structure in this light. Such objective indicia as commercial success, or filling an existing need, illuminate the technological and commercial environment of the inventor, and aid in understanding the state of the art at the time the invention was made. *See In re Piasecki*, 745 F.2d 1468, 1475, 223 U.S.P.Q. 785, 790 (Fed.Cir.1984) (secondary considerations "often establish that an invention appearing to have been obvious in light of the prior art was not" (quoting *Stratoflex, Inc.*

v. Aeroquip Corp., 713 F.2d 1530, 1538-39, 218 U.S.P.Q. 871, 879 (Fed.Cir.1983))).

Continental licensed the '324 counterpart Japanese patent to a Japanese company, Yoshino, that we are told had been unable to develop a plastic bottle for hot-fill applications. A witness for Toyo Seikan, another Japanese licensee, testified that the Conobase "sustains itself in higher temperatures, and it does not cause buckling after you fill [the bottle]", as compared with previously available plastic bottles. Continental asserts that Monsanto had been unable to develop a satisfactory bottle for hot-fill applications, and had therefore obtained this technology from Yoshino.

The district court acknowledged the commercial success of the Conobase, but stated that "we are not convinced that the conobase *alone* accounts for any of the success." 11 U.S.P.Q.2d at 1770 (emphasis in original). The court suggested that the commercial success in Japan was due to the market strength of the Japanese licensees, and held that there is no nexus between the merits of the product and its commercial success. It is not necessary, however, that the patented invention be solely responsible for the commercial success, in order for this factor to be given weight appropriate to the evidence, along with other pertinent factors. *See generally Demaco Corp. v. F. Von Langsdorff Licensing Ltd.*, 851 F.2d 1387, 1392-94, 7 U.S.P.Q.2d 1222, 1226-28 (Fed.Cir.), *cert. denied*, 488 U.S. 956, 109 S.Ct. 395, 102 L.Ed.2d 383 (1988); *Rosemount, Inc. v. Beckman Instruments, Inc.*, 727 F.2d 1540, 1546, 221 U.S.P.Q. 1, 7 (Fed.Cir.1984). Monsanto also states that the Conobase is different from the '324 invention, so that even were the Conobase successful, this does not inure to the benefit of the '324 patent. It is apparent that the factual issues surrounding the objective indicia were disputed, and material.

In view of the material facts requiring resolution, the issue of obviousness was not properly decided on motion for sum-

mary judgment. We vacate the grant based on 35 U.S.C. § 103, and remand for trial of this issue and the other issues remaining in the case.

REVERSED IN PART, VACATED IN PART, and REMANDED.



Costs

Costs in favor of Continental.